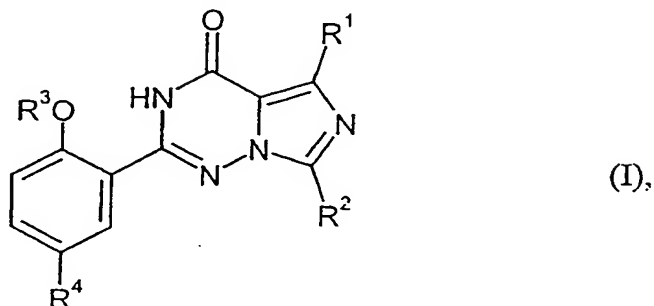


**Claims**

1. The use of compounds of the general formula (I)



5

in which

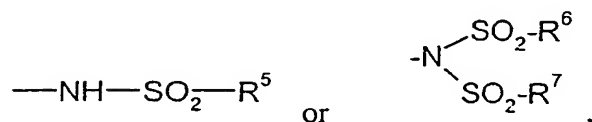
$R^1$  is (C<sub>1</sub>-C<sub>6</sub>)-alkyl,

10  $R^2$  is (C<sub>3</sub>-C<sub>8</sub>)-cycloalkyl or (C<sub>1</sub>-C<sub>12</sub>)-alkyl,

$R^3$  is (C<sub>1</sub>-C<sub>6</sub>)-alkyl,

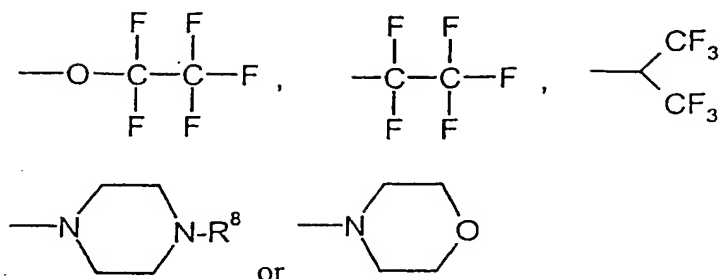
$R^4$  is a radical of the formulae

15



in which

20  $R^5$ ,  $R^6$  and  $R^7$  are identical or different and are vinyl or (C<sub>1</sub>-C<sub>6</sub>)-alkyl which is optionally substituted up to 3 times, identically or differently, by trifluoromethyl, halogen, (C<sub>1</sub>-C<sub>6</sub>)-alkoxy or by radicals of the formulae



in which

5  $R^8$  is hydrogen or  $(C_1-C_4)$ -alkyl,

or

10  $R^5$ ,  $R^6$  and/or  $R^7$  are  $(C_6-C_{12})$ -aryl which is optionally substituted up to 3 times, identically or differently, by halogen, trifluoromethyl, nitro, cyano, carboxyl,  $(C_1-C_6)$ -alkyl or  $(C_1-C_6)$ -alkoxy,

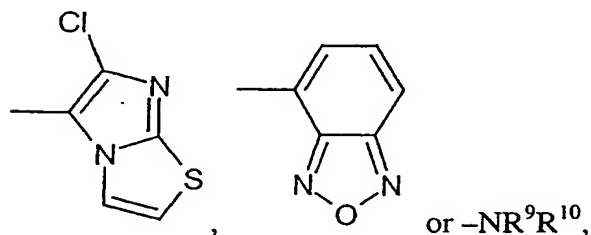
or

15  $R^5$  is quinolyl or a 5- to 6-membered, aromatic or saturated heterocycle having up to 3 heteroatoms from the series S, N and/or O, which may optionally be substituted, in the case of an N function also via the latter, up to 3 times, identically or differently, by halogen or  $(C_1-C_6)$ -alkyl,

20

or

$R^5$  is a radical of the formulae



25

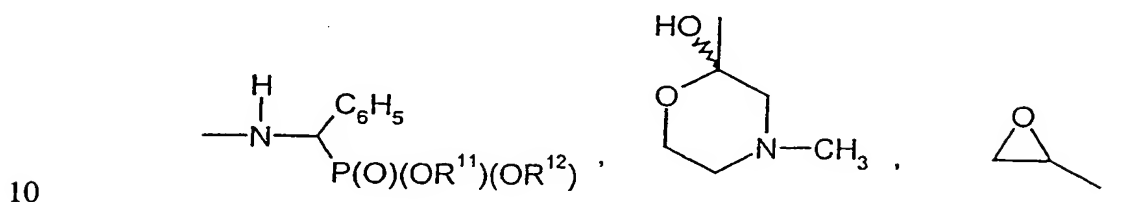
in which

$R^9$  and  $R^{10}$  are identical or different and are hydrogen,  $(C_1-C_6)$ -alkyl or phenyl,

5

or

$R^4$  is carboxyl or is a radical of the formulae



$-CO-R^{13}$  or  $-O-R^{14}$ ,

in which

15

$R^{11}$  and  $R^{12}$  are identical or different and are hydrogen or  $(C_1-C_4)$ -alkyl,

$R^{13}$  is  $(C_1-C_6)$ -alkyl,

20

$R^{14}$  is  $(C_1-C_6)$ -alkyl which is optionally substituted up to 3 times, identically or differently, by hydroxyl, phenyl or by a radical of the formula  $-NR^{15}R^{16}$ ,

in which

25

$R^{15}$  and  $R^{16}$  are identical or different and are hydrogen, phenyl or  $(C_1-C_4)$ -alkyl which in turn may be substituted by phenyl,

or

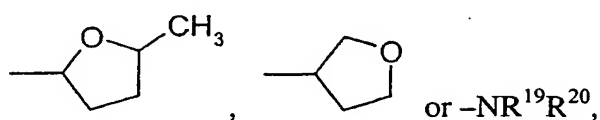
$R^4$  is a radical of the formula  $-NH-CO-NR^{17}R^{18}$ ,

in which

5

$R^{17}$  and  $R^{18}$  are identical or different and are hydrogen or  $(C_1-C_6)$ -alkyl which is optionally substituted by hydroxyl or by a radical of the formulae

10



in which

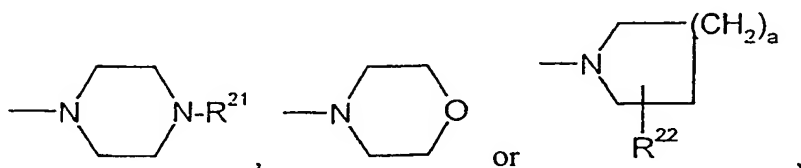
15

$R^{19}$  and  $R^{20}$  are identical or different and are hydrogen, phenyl or  $(C_1-C_6)$ -alkyl,

or

20

$R^{17}$  and  $R^{18}$  form together with the nitrogen atom to which they are bonded a heterocyclic ring of the formulae



in which

25

$R^{21}$  is hydrogen or  $(C_1-C_6)$ -alkyl,

$a$  is either 1 or 2,

$R^{22}$  is hydroxyl or  $(C_1-C_6)$ -alkyl which is optionally substituted by hydroxyl,

5 or

$R^{17}$  and/or  $R^{18}$  are  $(C_6-C_{12})$ -aryl which is optionally substituted by halogen, trifluoroethyl or by  $-SCF_3$ ,

10 or

$R^{17}$  is hydrogen and

$R^{18}$  is a radical of the formula  $-SO_2-R^{23}$ ,

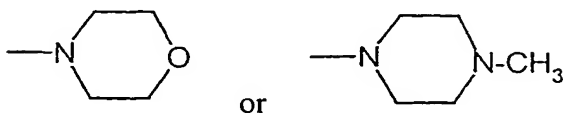
15

in which

$R^{23}$  is  $(C_1-C_6)$ -alkyl or  $(C_6-C_{12})$ -aryl which is optionally substituted by halogen,

20

or is a radical of the formulae



25 or

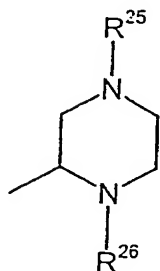
$R^4$  is a radical of the formula

$-NH-CO-R^{24}$ ,

30

in which

$R^{24}$  is a radical of the formula



5

in which

$R^{25}$  and  $R^{26}$  are identical or different and are hydrogen,  $(C_1-C_6)$ -alkyl or  $(C_1-C_6)$ -alkoxycarbonyl,

10

or

$R^{24}$  is  $(C_1-C_6)$ -alkyl which is optionally substituted by  $(C_6-C_{12})$ -aryl which in turn may be substituted by hydroxyl or  $(C_1-C_6)$ -alkoxy or

15

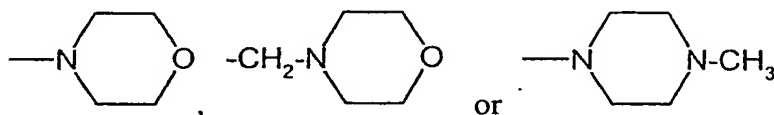
$(C_1-C_6)$ -alkyl is optionally substituted by a radical of the formula  $-(SO_2)_b-R^{27}$ ,

in which

20

$b$  is either 0 or 1, and

$R^{27}$  is a radical of the formulae



25

or

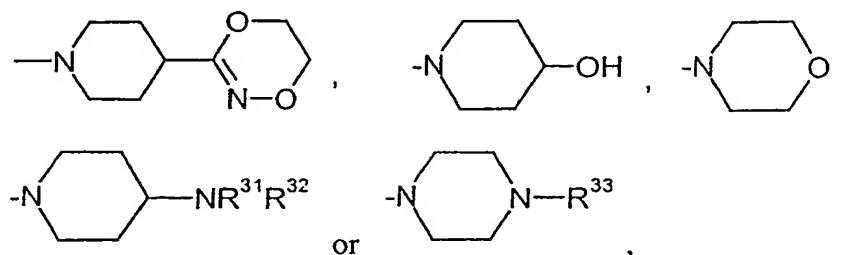
$R^4$  is  $(C_1-C_{12})$ -alkyl which is optionally substituted up to 3 times, identically or differently, by hydroxyl, azide, phenyl or by radicals of the formulae  
 5  $-NR^{28}R^{29}$ ,  $-O-CO-R^{30}$  or  $-P(O)\{O-[(C_1-C_6)\text{-alkyl}]\}_2$ ,

in which

$R^{28}$  and  $R^{29}$  are identical or different, are hydrogen, phenyl or  $(C_1-C_6)$ -alkyl  
 10 which is optionally substituted by hydroxyl,  $(C_1-C_6)$ -alkoxy or phenyl,

or

$R^{28}$  and  $R^{29}$  form together with the nitrogen atom to which they are bonded a  
 15 heterocyclic ring of the formulae



20

in which

$R^{31}$  and  $R^{32}$  are identical or different and are hydrogen or  $(C_1-C_6)$ -alkyl,

25

$R^{33}$  is  $(C_1-C_6)$ -alkyl, benzyl,  $(C_1-C_6)$ -alkoxycarbonyl,  $(C_1-C_6)$ -alkylcarbonyl, carboxyl, pyridyl, pyrimidyl or phenyl which is optionally substituted by  $(C_1-C_6)$ -alkoxy,

and

$R^{30}$  is  $(C_1-C_6)$ -alkyl,

or

5

$(C_1-C_{12})$ -alkyl is optionally substituted by triazolyl which may in turn be substituted up to twice, identically or differently, by halogen, phenyl, tetrahydrofuranyl, tetrahydropyranyl,  $(C_1-C_6)$ -alkoxycarbonyl, aminocarbonyl or by  $(C_1-C_6)$ -alkyl, where the latter can optionally be substituted by hydroxyl,  $(C_1-C_6)$ -alkoxy or by a radical of the formulae  $NR^{34}R^{35}$  or  $-O-CO-R^{36}$ ,

10

in which

15

$R^{34}$  and  $R^{35}$  are identical or different and are hydrogen or  $(C_1-C_6)$ -alkyl,

$R^{36}$  is  $(C_1-C_6)$ -alkyl,

or

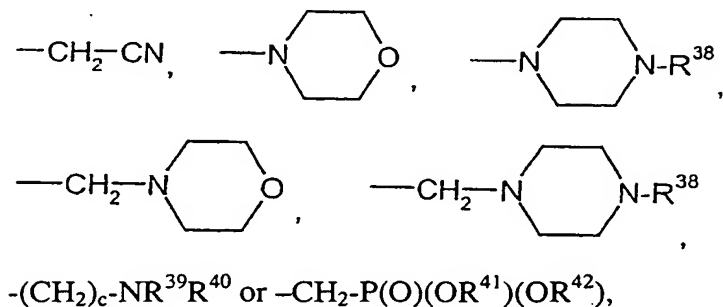
20

$R^4$  is a radical of the formula  $-CO-R^{37}$ ,

in which

25

$R^{37}$  is a radical of the formulae





in which

$R^{38}$  is hydrogen or  $(C_1-C_6)$ -alkyl,

5             $c$  is either 0 or 1,

$R^{39}$  and  $R^{40}$  are identical or different and are hydrogen or  $(C_1-C_6)$ -alkyl, which is optionally substituted by hydroxyl,

10            $R^{41}$  and  $R^{42}$  are identical or different and are  $(C_1-C_6)$ -alkyl,

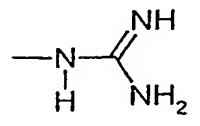
or

15            $R^4$  is a 5-membered heterocycle having up to 3 heteroatoms from the series S, N and/or O which is optionally substituted, in the case of an N function also via the latter, a total of up to 3 times, identically or differently, by halogen, trifluoromethyl or by phenyl which may in turn be substituted one or more times by halogen or trifluoromethyl,

20           and/or is optionally substituted by  $(C_3-C_6)$ -cycloalkyl, pyrrol or  $(C_1-C_{12})$ -alkyl which may in turn be substituted by cyano, trifluoromethyl,  $(C_1-C_6)$ -alkoxycarbonyl,  $(C_1-C_6)$ -alkoxy, amino or by phenyl or nitro-substituted phenyl,

25           and/or may optionally be substituted by  $-NR^{43}R^{44}$ ,  $-NH-CO-CO-R^{45}$ ,

$-NH-CO-R^{46}$ ,  $-NH-CO-CH_2-R^{47}$ ,  $-CO-R^{48}$  or



in which

$R^{43}$  and  $R^{44}$  are identical or different and are hydrogen, benzyl (C<sub>1</sub>-C<sub>6</sub>)-alkyl or phenyl which is optionally substituted by halogen or trifluoromethyl,

5  $R^{45}$  is (C<sub>1</sub>-C<sub>6</sub>)-alkoxy,

$R^{46}$  is (C<sub>1</sub>-C<sub>6</sub>)-alkyl or phenyl,

10  $R^{47}$  is hydroxyl, (C<sub>1</sub>-C<sub>6</sub>)-alkoxy or a radical of the formula  $-O-CO-R^{49}$ ,  
in which

$R^{49}$  is (C<sub>1</sub>-C<sub>4</sub>)-alkyl,

15  $R^{48}$  is a radical of the formula  $-CH_2-CN$  or phenyl which is optionally substituted by halogen, trifluoromethyl or (C<sub>1</sub>-C<sub>6</sub>)-alkoxy,

and the salts, tautomers, N-oxides, prodrugs and hydrates thereof, and isomeric forms,

20 for the prophylaxis and/or treatment of disorders associated with cGMP-regulated processes ('cGMP-related diseases').

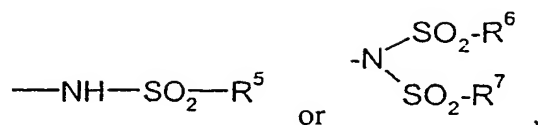
2. The use as claimed in claim 1, where in the compounds of the general  
25 formula (I)

$R^1$  is (C<sub>1</sub>-C<sub>4</sub>)-alkyl,

$R^2$  is cyclopentyl, cycloheptyl or (C<sub>1</sub>-C<sub>10</sub>)-alkyl,

30  $R^3$  is (C<sub>1</sub>-C<sub>4</sub>)-alkyl,

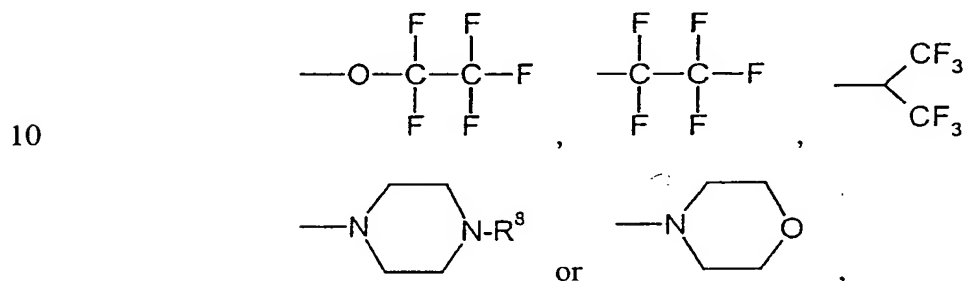
$R^4$  is a radical of the formulae



in which

5

$\text{R}^5$ ,  $\text{R}^6$  and  $\text{R}^7$  are identical or different and are vinyl or (C<sub>1</sub>-C<sub>4</sub>)-alkyl which is optionally substituted up to 3 times, identically or differently, by trifluoromethyl, chlorine, (C<sub>1</sub>-C<sub>4</sub>)-alkoxy or by radicals of the formulae



in which

15

$\text{R}^8$  is hydrogen, methyl or ethyl,

or

20

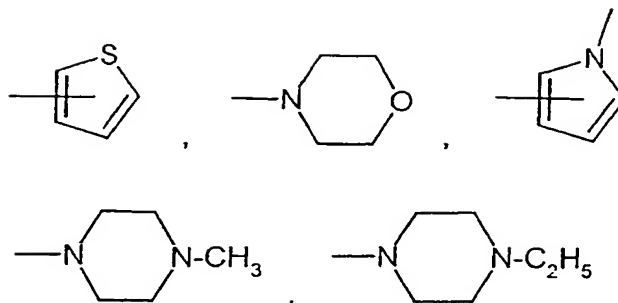
$\text{R}^5$ ,  $\text{R}^6$  and/or  $\text{R}^7$  are phenyl which is optionally substituted up to 3 times, identically or differently by halogen, trifluoromethyl, nitro, cyano, carboxyl, (C<sub>1</sub>-C<sub>4</sub>)-alkyl or (C<sub>1</sub>-C<sub>4</sub>)-alkoxy,

or

25

$\text{R}^5$  is quinolyl or a radical of the formulae

- 54 -

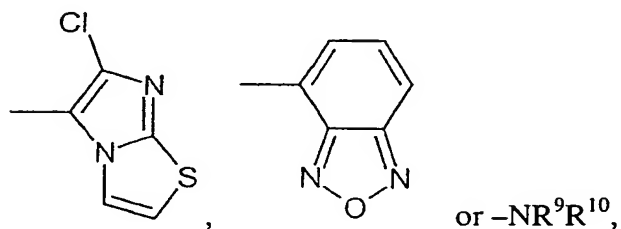


which may optionally be substituted up to twice, identically or differently, by chlorine or (C<sub>1</sub>-C<sub>4</sub>)-alkyl,

5

or

$R^5$  is a radical of the formulae



10

in which

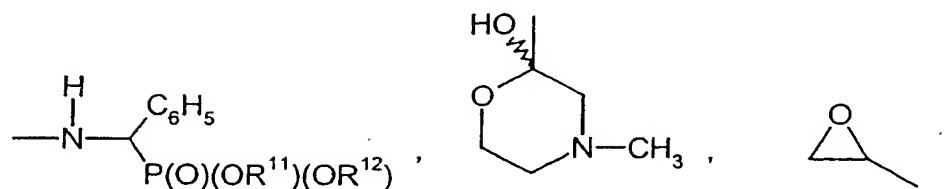
$R^9$  and  $R^{10}$  are identical or different and are hydrogen, (C<sub>1</sub>-C<sub>6</sub>)-alkyl or phenyl,

15

or

$R^4$  is carboxyl or is a radical of the formulae

20



-CO-R<sup>13</sup> or -O-R<sup>14</sup>,

5 in which

R<sup>11</sup> and R<sup>12</sup> are identical or different and are hydrogen or (C<sub>1</sub>-C<sub>4</sub>)-alkyl,

R<sup>13</sup> is (C<sub>1</sub>-C<sub>4</sub>)-alkyl,

10

R<sup>14</sup> is (C<sub>1</sub>-C<sub>4</sub>)-alkyl which is optionally substituted up to 3 times, identically or differently, by hydroxyl, phenyl or by a radical of the formula -NR<sup>15</sup>R<sup>16</sup>,

15

in which

R<sup>15</sup> and R<sup>16</sup> are identical or different and are hydrogen, phenyl or (C<sub>1</sub>-C<sub>4</sub>)-alkyl which may in turn be substituted by phenyl,

20 or

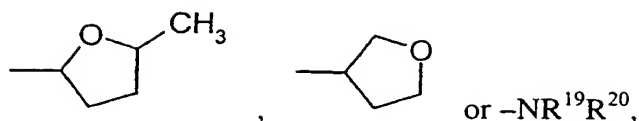
R<sup>4</sup> is a radical of the formula -NH-CO-NR<sup>17</sup>R<sup>18</sup>,

in which

25

R<sup>17</sup> and R<sup>18</sup> are identical or different and are hydrogen or (C<sub>1</sub>-C<sub>4</sub>)-alkyl which is optionally substituted by hydroxyl or by a radical of the formulae

- 56 -

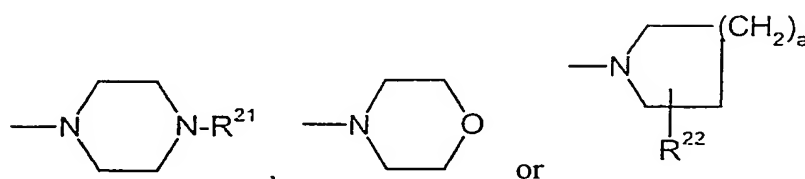


in which

5 R<sup>19</sup> and R<sup>20</sup> are identical or different and are hydrogen, phenyl or (C<sub>1</sub>-C<sub>4</sub>)-alkyl,

or

10 R<sup>17</sup> and R<sup>18</sup> form together with the nitrogen atom to which they are bonded a heterocyclic ring of the formulae



15 in which

R<sup>21</sup> is hydrogen or (C<sub>1</sub>-C<sub>4</sub>)-alkyl,

a is either 1 or 2,

20

R<sup>22</sup> is hydroxyl or (C<sub>1</sub>-C<sub>4</sub>)-alkyl which is optionally substituted by hydroxyl,

or

25

R<sup>17</sup> and/or R<sup>18</sup> are phenyl which is optionally substituted by chlorine, trifluoroethyl or by -SCF<sub>3</sub>,

or

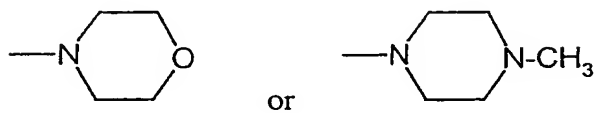
$R^{17}$  is hydrogen, and

5  $R^{18}$  is a radical of the formula  $-\text{SO}_2\text{-R}^{23}$ ,

in which

10  $R^{23}$  is  $(\text{C}_1\text{-C}_4)$ -alkyl or phenyl which is optionally substituted by halogen,

or is a radical of the formulae



or

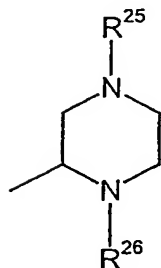
$R^4$  is a radical of the formula

20  $-\text{NH-CO-R}^{24}$

in which

$R^{24}$  is a radical of the formula

25



in which

5  $R^{25}$  and  $R^{26}$  are identical or different and are hydrogen, (C<sub>1</sub>-C<sub>4</sub>)-alkyl or (C<sub>1</sub>-C<sub>4</sub>)-alkoxycarbonyl,

or

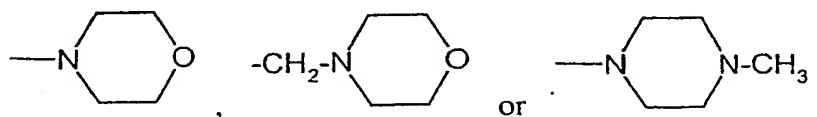
10  $R^{24}$  is (C<sub>1</sub>-C<sub>4</sub>)-alkyl which is optionally substituted by phenyl which may in turn be substituted by hydroxyl or (C<sub>1</sub>-C<sub>4</sub>)-alkoxy, or

(C<sub>1</sub>-C<sub>4</sub>)-alkyl is optionally substituted by a radical of the formula  $-(SO_2)_b-R^{27}$

15 in which

b is either 0 or 1, and

20  $R^{27}$  is a radical of the formulae



or

25  $R^4$  is (C<sub>1</sub>-C<sub>11</sub>)-alkyl which is optionally substituted up to 3 times, identically or differently, by hydroxyl, azide, phenyl or by radicals of the formulae  $\text{—NR}^{28}\text{R}^{29}$ ,  $\text{—O—CO—R}^{30}$  or  $\text{—P(O)\{O—[ (C}_1\text{—C}_6\text{)—alkyl]\}_2}$ ,

in which

30

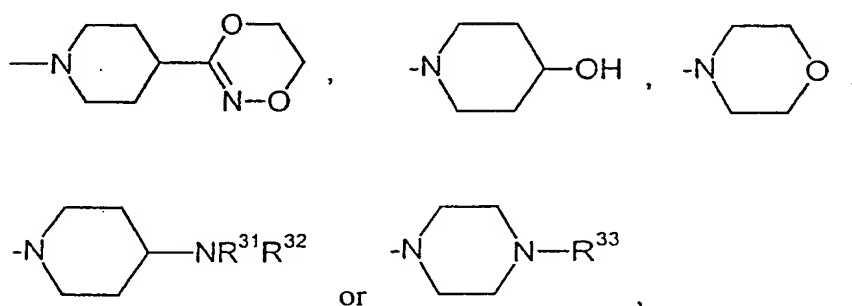


$R^{28}$  and  $R^{29}$  are identical or different and are hydrogen, phenyl or (C<sub>1</sub>-C<sub>4</sub>)-alkyl which is optionally substituted by hydroxyl, (C<sub>1</sub>-C<sub>4</sub>)-alkoxy or phenyl,

5 or

$R^{28}$  and  $R^{29}$  form together with the nitrogen atom to which they are bonded a heterocyclic ring of the formulae

10



in which

15

$R^{31}$  and  $R^{32}$  are identical or different and are hydrogen or (C<sub>1</sub>-C<sub>4</sub>)-alkyl,

20

$R^{33}$  is (C<sub>1</sub>-C<sub>4</sub>)-alkyl, benzyl, (C<sub>1</sub>-C<sub>4</sub>)-alkoxycarbonyl, (C<sub>1</sub>-C<sub>4</sub>)-alkylcarbonyl, carboxyl, pyridyl, pyrimidyl or phenyl which is optionally substituted by (C<sub>1</sub>-C<sub>4</sub>)-alkoxy,

and

25

$R^{30}$  is (C<sub>1</sub>-C<sub>6</sub>)-alkyl,

or

(C<sub>1</sub>-C<sub>11</sub>)-alkyl is optionally substituted by triazolyl which may in turn be substituted up to twice, identically or differently, by halogen, phenyl, tetrahydrofuranyl, tetrahydropyranyl, (C<sub>1</sub>-C<sub>4</sub>)-alkoxycarbonyl, aminocarbonyl or by (C<sub>1</sub>-C<sub>4</sub>)-alkyl, where the latter may optionally be substituted by hydroxyl, (C<sub>1</sub>-C<sub>4</sub>)-alkoxy or by a radical of the formulae NR<sup>34</sup>R<sup>35</sup> or -O-CO-R<sup>36</sup>,

in which

R<sup>34</sup> and R<sup>35</sup> are identical or different and are hydrogen or (C<sub>1</sub>-C<sub>4</sub>)-alkyl,

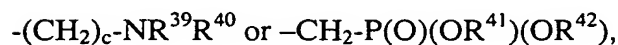
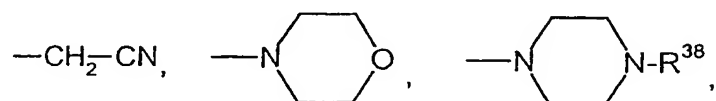
R<sup>36</sup> is (C<sub>1</sub>-C<sub>4</sub>)-alkyl,

or

R<sup>4</sup> is a radical of the formula -CO-R<sup>37</sup>

in which

R<sup>37</sup> is a radical of the formulae



25

in which

$R^{38}$  is hydrogen or (C<sub>1</sub>-C<sub>4</sub>)-alkyl,

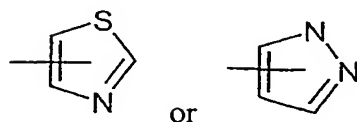
c is either 0 or 1,

5  $R^{39}$  and  $R^{40}$  are identical or different and are hydrogen or (C<sub>1</sub>-C<sub>4</sub>)-alkyl which is optionally substituted by hydroxyl,

$R^{41}$  and  $R^{42}$  are identical or different and are (C<sub>1</sub>-C<sub>4</sub>)-alkyl,

10 or

$R^4$  is a radical of the formula



15

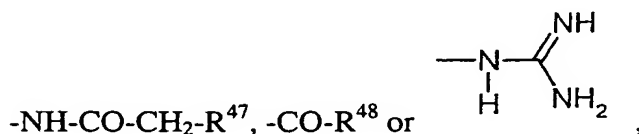
which is optionally substituted, in the case of pyrazole also via the N function, a total of up to 3 times, identically or differently, by chlorine, trifluoromethyl or by phenyl which may in turn be substituted one or more times by chlorine or trifluoromethyl,

20

and/or is optionally substituted by cyclopentyl, cyclohexyl, pyrrol or (C<sub>1</sub>-C<sub>12</sub>)-alkyl which may in turn be substituted by cyano, trifluoromethyl, (C<sub>1</sub>-C<sub>4</sub>)-alkoxycarbonyl, (C<sub>1</sub>-C<sub>4</sub>)-alkoxy, amino or by phenyl or nitro-substituted phenyl,

25

and/or may also be substituted by  $-NR^{43}R^{44}$ ,  $-NH-CO-CO-R^{45}$ ,  $-NH-CO-R^{46}$ ,



in which

5             $R^{43}$  and  $R^{44}$  are identical or different and are hydrogen, benzyl, (C<sub>1</sub>-C<sub>4</sub>)-alkyl  
             or phenyl which is optionally substituted by halogen or  
             trifluoromethyl,

$R^{45}$  is (C<sub>1</sub>-C<sub>5</sub>)-alkoxy,

10            $R^{46}$  is (C<sub>1</sub>-C<sub>5</sub>)-alkyl or phenyl,

$R^{47}$  is hydroxyl, (C<sub>1</sub>-C<sub>4</sub>)-alkoxy or a radical of the formula  $-O-CO-R^{49}$ ,

             in which

15            $R^{49}$  is (C<sub>1</sub>-C<sub>3</sub>)-alkyl,

$R^{48}$  is a radical of the formula  $-CH_2-CN$  or phenyl which is optionally  
             substituted by chlorine, trifluoromethyl or (C<sub>1</sub>-C<sub>4</sub>)-alkoxy,

20        and the tautomers thereof, and the pharmaceutically acceptable salts, hydrates and  
             prodrugs thereof.

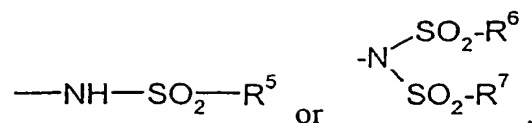
3.        The use as claimed in claim 1, where in the general formula (I)

25         $R^1$  is (C<sub>1</sub>-C<sub>4</sub>)-alkyl,

$R^2$  is cyclopentyl, cyclohexyl, cycloheptyl or (C<sub>1</sub>-C<sub>10</sub>)-alkyl,

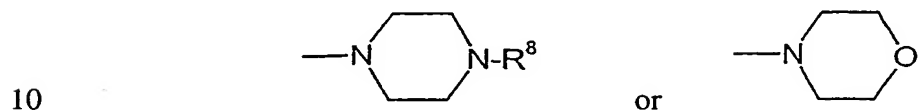
$R^3$  is (C<sub>1</sub>-C<sub>4</sub>)-alkyl,

30         $R^4$  is a radical of the formulae



in which

- 5  $\text{R}^5$ ,  $\text{R}^6$  and  $\text{R}^7$  are identical or different and are vinyl or (C<sub>1</sub>-C<sub>4</sub>)-alkyl which is optionally substituted up to 3 times, identically or differently, by trifluoromethyl, chlorine, (C<sub>1</sub>-C<sub>4</sub>)-alkoxy or by radicals of the formulae



in which

- 15  $\text{R}^8$  is hydrogen, methyl or ethyl,

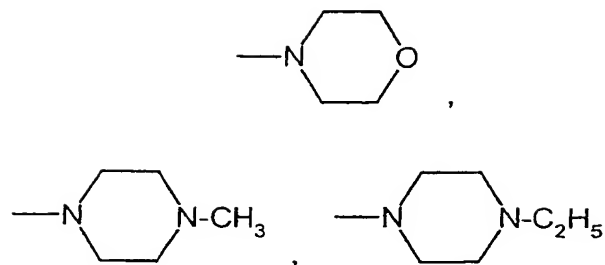
or

- 20  $\text{R}^5$ ,  $\text{R}^6$  and/or  $\text{R}^7$  are phenyl which is optionally substituted up to 3 times, identically or differently, by halogen, cyano, (C<sub>1</sub>-C<sub>4</sub>)-alkyl or (C<sub>1</sub>-C<sub>4</sub>)-alkoxy,

or

- 25  $\text{R}^5$  is a radical of the formulae

- 64 -



which may optionally be substituted up to twice, identically or differently, by chlorine or (C<sub>1</sub>-C<sub>4</sub>)-alkyl,

5

or

R<sup>5</sup> is a radical of the formula -NR<sup>9</sup>R<sup>10</sup>,

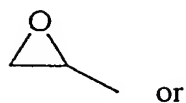
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in which

R<sup>9</sup> and R<sup>10</sup> are identical or different and are hydrogen, (C<sub>1</sub>-C<sub>4</sub>)-alkyl or phenyl,

15 or

R<sup>4</sup> is carboxyl or is a radical of the formulae



or

20

-CO-R<sup>13</sup> or -O-R<sup>14</sup>,

in which

25

R<sup>13</sup> is (C<sub>1</sub>-C<sub>4</sub>)-alkyl,

$R^{14}$  is (C<sub>1</sub>-C<sub>4</sub>)-alkyl which is optionally substituted up to 3 times, identically or differently, by hydroxyl or by a radical of the formula -NR<sup>15</sup>R<sup>16</sup>,

5 in which

$R^{15}$  and  $R^{16}$  are identical or different and are hydrogen or (C<sub>1</sub>-C<sub>4</sub>)-alkyl which in turn may be substituted by phenyl,

10 or

$R^4$  is a radical of the formula -NH-CO-NR<sup>17</sup>R<sup>18</sup>,

in which

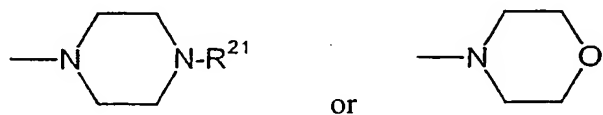
15

$R^{17}$  and  $R^{18}$  are identical or different and are hydrogen or (C<sub>1</sub>-C<sub>4</sub>)-alkyl which is optionally substituted by hydroxyl,

or

20

$R^{17}$  and  $R^{18}$  form together with the nitrogen atom to which they are bonded a heterocyclic ring of the formulae



25

in which

$R^{21}$  is hydrogen or (C<sub>1</sub>-C<sub>4</sub>)-alkyl,

30

or

$R^{17}$  and/or  $R^{18}$  are phenyl which is optionally substituted by chlorine, trifluoroethyl or by  $-\text{SCF}_3$ ,

or

5

$R^{17}$  is hydrogen, and

$R^{18}$  is a radical of the formula  $-\text{SO}_2-\text{R}^{23}$ ,

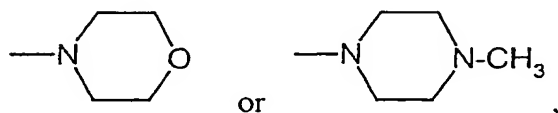
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in which

$R^{23}$  is  $(\text{C}_1\text{-C}_4)$ -alkyl or phenyl which is optionally substituted by halogen,

15

or is a radical of the formulae



or

20

$R^4$  is a radical of the formula

$-\text{NH}-\text{CO}-\text{R}^{24}$ ,

25

in which

$R^{24}$  is  $(\text{C}_1\text{-C}_4)$ -alkyl which is optionally substituted by phenyl which in turn may optionally be substituted by hydroxyl or  $(\text{C}_1\text{-C}_4)$ -alkoxy, or

30

$(\text{C}_1\text{-C}_4)$ -alkyl is optionally substituted by a radical of the formula  $-(\text{SO}_2)_b-\text{R}^{27}$ ,

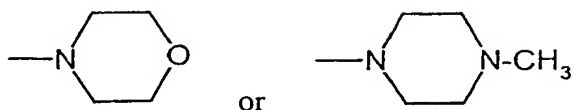


in which

b is either 0 or 1, and

5

$R^{27}$  is a radical of the formulae



10 or

$R^4$  is  $(C_1-C_6)$ -alkyl which is optionally substituted up to 3 times, identically or differently, by hydroxyl, phenyl or by radicals of the formulae  $-NR^{28}R^{29}$  or  $-O-CO-R^{30}$ ,

15

in which

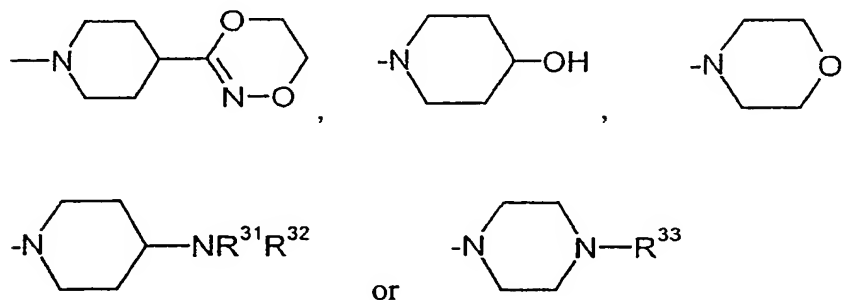
$R^{28}$  and  $R^{29}$  are identical or different, are hydrogen, phenyl or  $(C_1-C_4)$ -alkyl which is optionally substituted by hydroxyl,  $(C_1-C_4)$ -alkoxy or phenyl,

20

or

$R^{28}$  and  $R^{29}$  form together with the nitrogen atom to which they are bonded a heterocyclic ring of the formulae

25



in which

5  $R^{31}$  and  $R^{32}$  are identical or different and are hydrogen or (C<sub>1</sub>-C<sub>4</sub>)-alkyl,

$R^{33}$  is (C<sub>1</sub>-C<sub>4</sub>)-alkyl, benzyl, (C<sub>1</sub>-C<sub>4</sub>)-alkoxycarbonyl, (C<sub>1</sub>-C<sub>4</sub>)-alkylcarbonyl, carboxyl, pyridyl, pyrimidyl or phenyl which is optionally substituted by (C<sub>1</sub>-C<sub>4</sub>)-alkoxy,

10 and

$R^{30}$  is (C<sub>1</sub>-C<sub>6</sub>)-alkyl,

or

15

(C<sub>1</sub>-C<sub>6</sub>)-alkyl is optionally substituted by triazolyl which may in turn be substituted up to twice, identically or differently, by (C<sub>1</sub>-C<sub>4</sub>)-alkyl, where the latter may optionally be substituted by hydroxyl or (C<sub>1</sub>-C<sub>4</sub>)-alkoxy,

20 in which

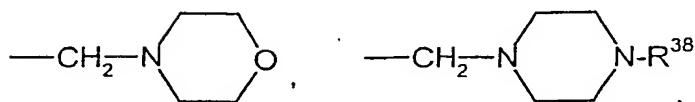
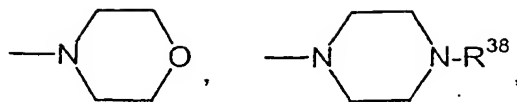
or

$R^4$  is a radical of the formula  $-\text{CO}-R^{37}$ ,

25

in which

$R^{37}$  is a radical of the formulae



or  $-(CH_2)_c-NR^{39}R^{40}$ ,

5 in which

R<sup>38</sup> is hydrogen or (C<sub>1</sub>-C<sub>4</sub>)-alkyl,

c is either 0 or 1,

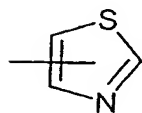
10

R<sup>39</sup> and R<sup>40</sup> are identical or different and are hydrogen or (C<sub>1</sub>-C<sub>4</sub>)-alkyl which is optionally substituted by hydroxyl,

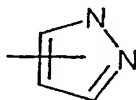
or

15

R<sup>4</sup> is a radical of the formula



or



20

which is optionally substituted, in the case of pyrazole also via the N function, a total of up to 3 times, identically or differently, by trifluoromethyl or by phenyl which may in turn be substituted one or more times by chlorine or trifluoromethyl,

and/or is optionally substituted by cyclopentyl, cyclohexyl or by (C<sub>1</sub>-C<sub>6</sub>)-alkyl which may in turn be substituted by (C<sub>1</sub>-C<sub>4</sub>)-alkoxy, amino or by phenyl,

5 and/or may optionally be substituted by -NR<sup>43</sup>R<sup>44</sup>, -NH-CO-R<sup>46</sup>, -NH-CO-CH<sub>2</sub>-R<sup>47</sup> or -CO-R<sup>48</sup>,

in which

10 R<sup>43</sup> and R<sup>44</sup> are identical or different and are hydrogen, benzyl, (C<sub>1</sub>-C<sub>4</sub>)-alkyl or phenyl which is optionally substituted by halogen or trifluoromethyl,

R<sup>46</sup> is (C<sub>1</sub>-C<sub>4</sub>)-alkyl or phenyl,

15

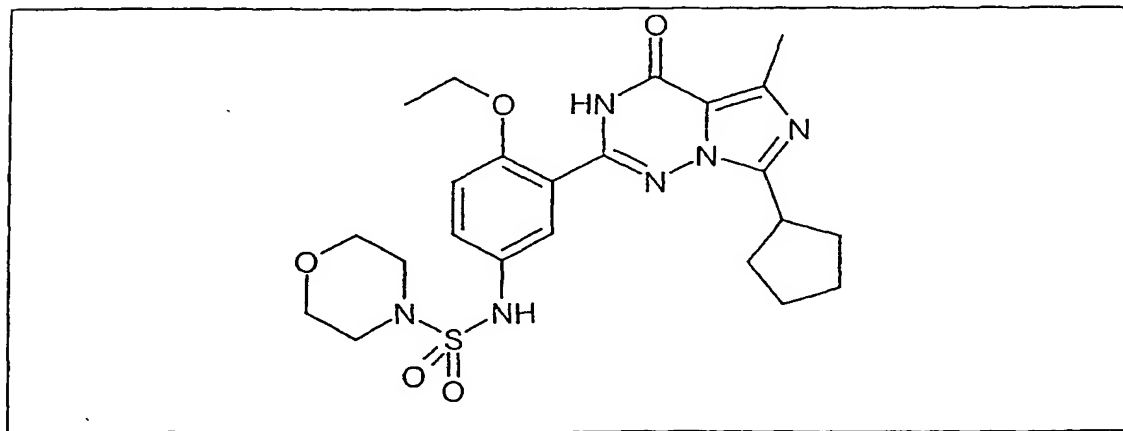
R<sup>47</sup> is hydroxyl or (C<sub>1</sub>-C<sub>4</sub>)-alkoxy,

R<sup>48</sup> is phenyl which is optionally substituted by chlorine, trifluoromethyl or (C<sub>1</sub>-C<sub>4</sub>)-alkoxy,

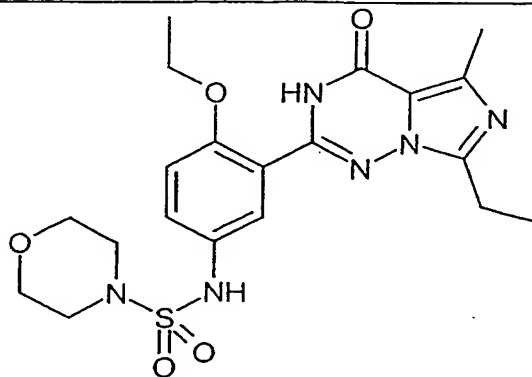
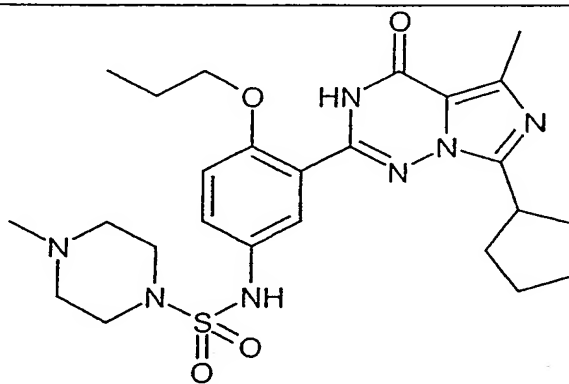
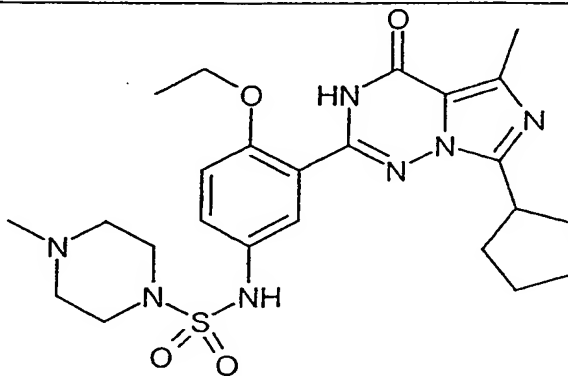
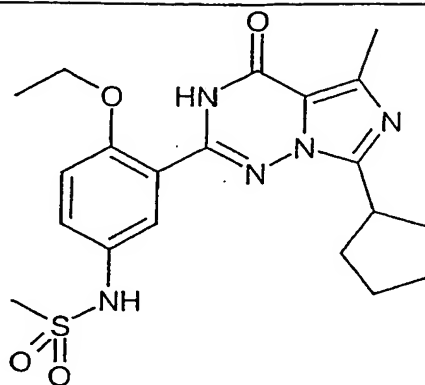
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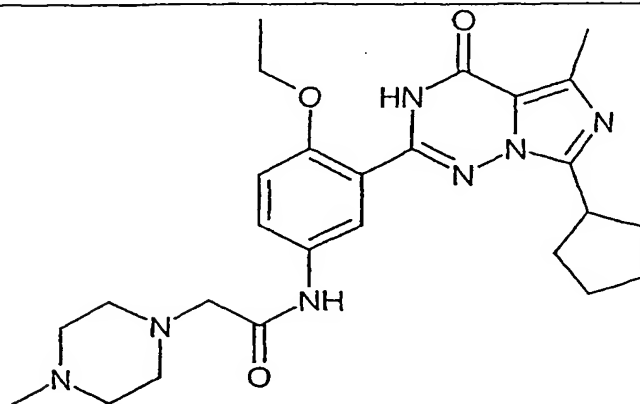
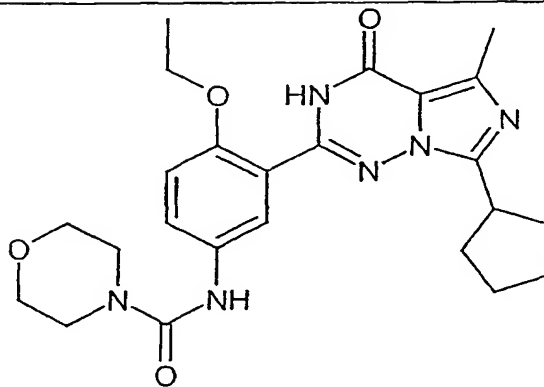
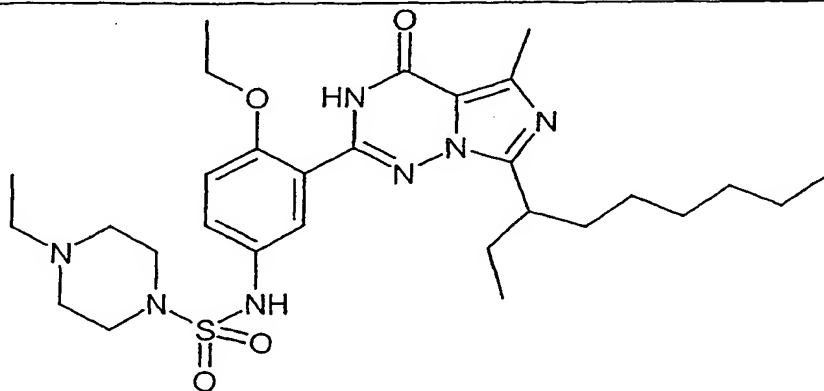
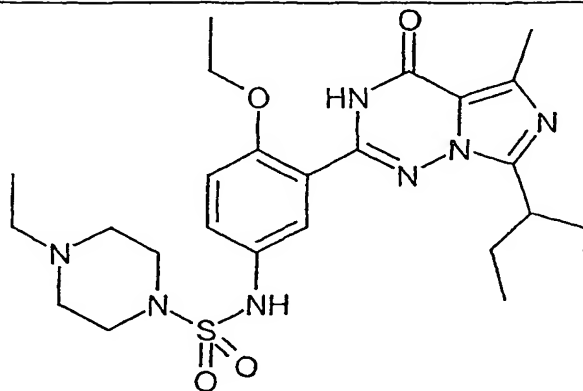
and the tautomers thereof, and the pharmaceutically acceptable salts, hydrates and prodrugs thereof.

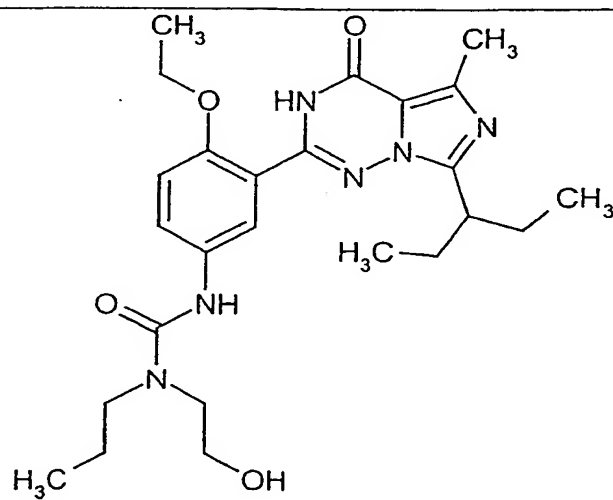
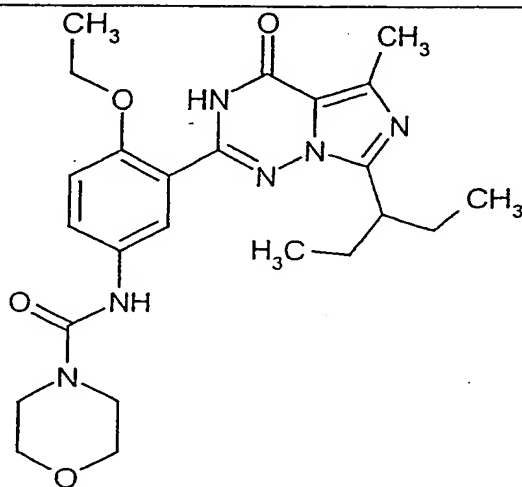
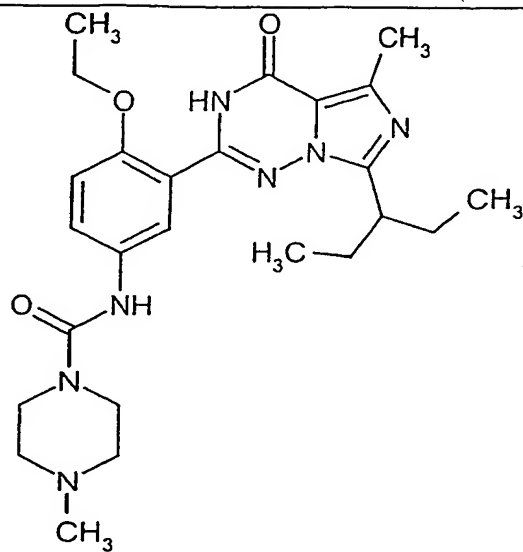
4. The use as claimed in claim 1 of compounds having the following structures:

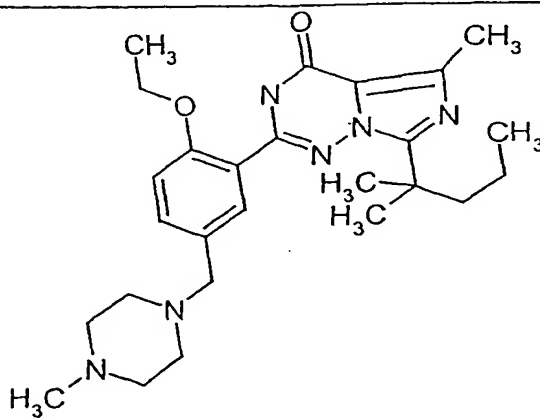
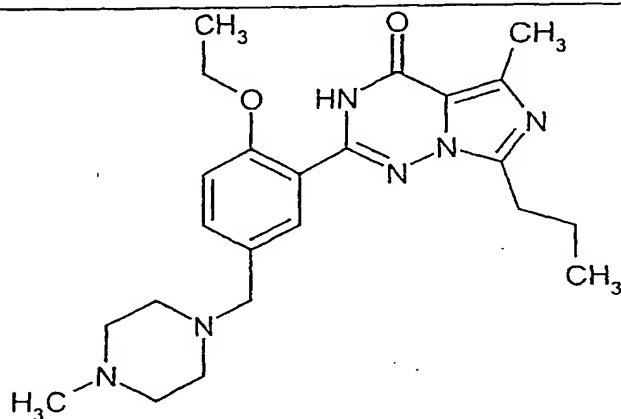
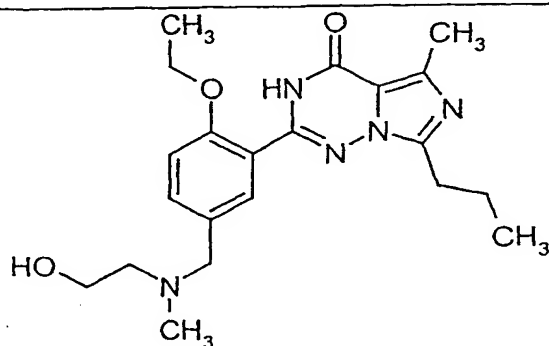
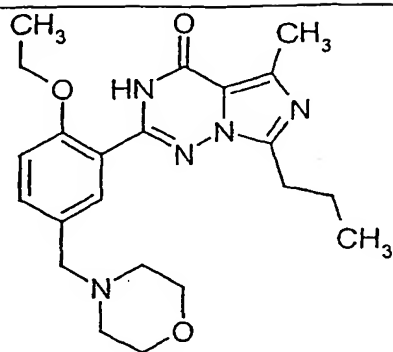


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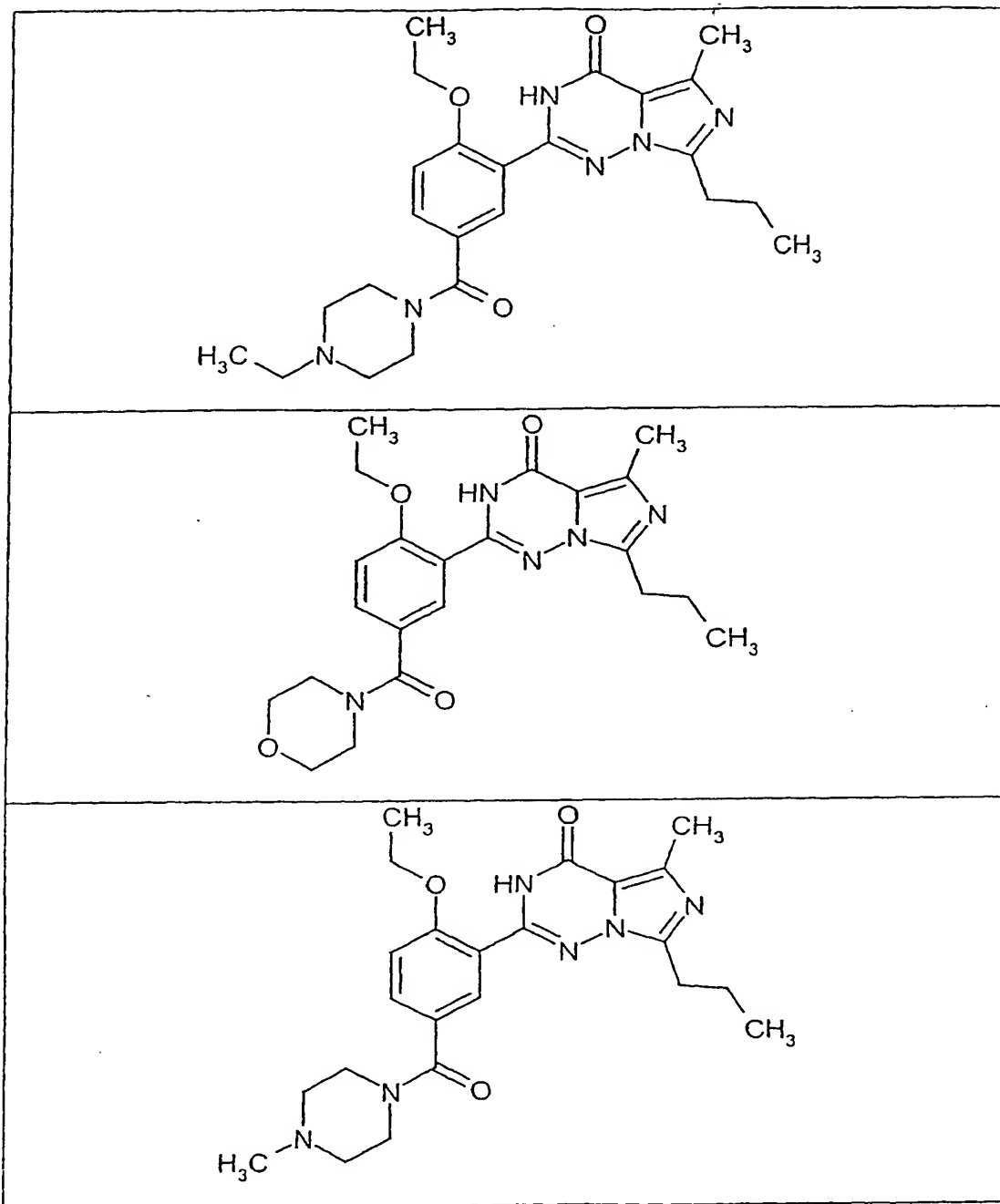












and the tautomers thereof, and the pharmaceutically acceptable salts, hydrates and prodrugs thereof.

5

5. The use of compounds as defined in claims 1 to 4 for producing medicaments for the prophylaxis and/or treatment of disorders associated with cGMP-regulated processes ('cGMP-related diseases').

6. The use of compounds as defined in claims 1 to 4 for producing medicaments for the treatment of diseases in which an improvement and/or cure of the pathological condition can be achieved by improving the microcirculation of a tissue which comprises a cGMP-metabolizing phosphodiesterase.
7. The use of compounds as defined in claims 1 to 4 for producing medicaments for the treatment of and/or prophylaxis of coronary heart disease, heart failure, pulmonary hypertension, bladder disorders, prostate hyperplasia, nitrate-induced tolerance, ocular disorders such as glaucoma, for the treatment or prophylaxis of central retinal or posterior ciliary arterial occlusion, central retinal venous occlusion, optic neuropathy such as anterior ischemic optic neuropathy and glaucomatous optic neuropathy, and of macular degeneration, diabetes, for the treatment of disorders of the peristalsis of stomach and esophagus, female infertility, premature labor, preeclampsia, alopecia, psoriasis, the renal syndrome, cystic fibrosis, cancer, for improving perception, for improving concentration, for improving learning and/or memory.